

Symposium: Attending to Student Diversity in Mathematics Education in Inclusive Settings

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Classrooms worldwide are becoming increasingly diverse. The term ‘diversity’ is contextual and often ambiguous. At a foundational level, ‘diversity’ is a descriptive term that refers to individual differences and needs (Forghani-Arani et al., 2019). The type of individual differences varies to include the following dimensions “migration, ethnic groups, national minorities and Indigenous peoples; gender; gender identity and sexual orientation; special education needs; and giftedness” (OECD, 2023, About us section). The OECD definition captures a range of individual differences, but it is essential to recognise that these differences can occur simultaneously, be intersecting, and often inseparable. In this way, an individual could have multiple dimensions of diversity in which they differ from others.

The multi-dimensionality or ‘hyper-diversity’ recognises the “intense diversification of the population, not only in socio-economic, socio-demographic and ethnic terms, but also with respect to lifestyles, attitudes and activities” (Tasan-Kok et al., 2013, p. 8). We adopt the term ‘hyper-diversity’ to refer to students who have multiple dimensions of diversity. In light of growing student diversity, there is a need for more research (Rigney & Rinaldi, 2023). We would extend this claim to students who are ‘hyper-diverse’. This symposium showcases different dimensions of diversity, focusing on students with diverse needs in inclusive mathematics education. The papers explore students with diverse needs from the early primary years to post-secondary schooling, highlighting the importance of inclusiveness across the lifespan.

Chair: Kate Quane.

Paper 1: *Reflecting on the school mathematics experiences of adults with Down Syndrome.*
 Matt Thompson, Catherine Attard and Kathryn Holmes.

Paper 2: *“Look at solutions”: Differentiated instruction (DI) in senior secondary mathematics.*
 Lorraine Gaunt and Tom Porta.

Paper 3: *Participation in mathematics for a student with blindness or low vision in Australian mainstream schools: A longitudinal case study.*
 Melissa Fanshawe and Melissa Cain.

Paper 4: *Opportunities for hyper-diverse students to communicate their mathematical thinking in multi-year classes.*
 Kate Quane and Bec Neill.

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Reflecting on the School Mathematics Experiences of Adults with Down Syndrome

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This paper reports on a section of a larger study, investigating the mathematics experiences of Down syndrome (DS) learners in Australian Primary Schools. Developing the numeracy skills to experience independence in post school settings is crucial for individuals with DS. The aim of this paper is to share the school mathematics experiences of six DS adults and their parents/carers to ascertain if their experiences (DS adults) with mathematics when they were at school have had consequences for how they engage and participate in society as adults. Initial findings suggest that DS adults' mathematics experiences have impacted on their quality of life in a post-school setting.

Down syndrome (DS) is the most commonly occurring chromosomal disorder in Australia with 1 in every 1100 births resulting in a DS diagnosis (Miller, 2015). Individuals with DS often have an intellectual disability and experience significant developmental delays. At the beginning of the 21st century, research alluded that most individuals with DS would struggle and have difficulties with learning mathematics (Bird & Buckley, 2001). Fortunately, contemporary research highlights the need for encouraging further mathematics education research, aiming to find new ways to bring positive mathematics experiences to this population (Faragher & Gil Clemente, 2019). This need is grounded in the fact "that mathematics can contribute, like other disciplines (language, theatre, sports) to the holistic development of people with DS especially with respect to thinking skills and awareness of the world" (Faragher & Gil Clemente, 2019, p. 112).

Importance of Positive Mathematics Experiences

Many individuals in society have a negative disposition towards mathematics as a result of their experiences with the subject at school. These experiences can be the result of teachers not having the pedagogical content knowledge in mathematics to design mathematics experiences for students that are substantively engaging, purposeful, and relevant to students' lives, and that are reflective of the individual needs of each student (Martin et al., 2009). Consequently, sustained student engagement, attainment of the subject in the later years of schooling as well later career choices are all factors that have the potential to be negatively impacted as a result of students' adverse experiences when learning mathematics (Bourgeois & Boberg, 2016). Interestingly, this research is usually only undertaken with students without intellectual disabilities in mainstream schools.

However, it can be argued that negative experiences in mathematics, leading to negative consequences in adult life could equally be as applicable and devastating to students with intellectual disabilities. Specific to individuals with DS, developing the appropriate numeracy skills needed to be able to function in, contribute to, and make sense of the world in which they live is crucial for them to experience independence, develop a sense of purpose, and function as a member of wider society (Faragher, 2019).

Methodology

Snowball sampling was used to recruit six DS adults and their parents/caregivers to participate in a joint semi-structured interview. Interview questions were designed to garner the

perspectives of these individuals and their parents/caregivers about their mathematics experiences when they were at school. The methodology literature that explores research in marginalised contexts, highlight the importance of not interviewing those with disabilities in isolation. Kelly (2007) attests to this notion and states that “gaining access to marginalised groups may be difficult, and that, in the case of those with disabilities, it is likely to be necessary to gain access through gatekeepers” (p. 24) such as parents/caregivers. The DS adult participants were given the option to provide their own informed consent ($n = 1$) or have their parents consent for them ($n = 5$) and to participate in their own separate interview ($n = 0$) or to be interviewed with their parents ($n = 6$).

Findings

This section reports on the findings from the interviews of each participant group (pseudonyms used), made up of the DS adults and their parents/caregivers. Thematic analysis underpinned by Brofenbrenner’s ecological model (1994) was used to analyse interview data.

Participant Group One—Michael and Tania

Michael is twenty-two years old and completed school four years ago. He was in a support unit that was in a mainstream public school for both primary and secondary school. When reflecting on Michael’s school experience with mathematics, his mother, Tania said, “They [school] probably could have done a bit more … expanded on it [mathematics] instead of just limiting him, because now he is probably working at a year two level … I can see it now … his understanding is still not great.” Tania also acknowledged in the interview that she felt that Michael was never challenged with his learning, “I found that they [school] almost expected him to be behind and not be able to do things, this was completely the opposite for my other kids, if they were struggling with something at school, I was told straight away.”

Participant Group Two—David and Kate

David is 24 years old and completed school six years ago. He was home-schooled for his first year of school, then attended a support unit in a public school for Year 1 and Year 2. Due to negative experiences with his teacher and class during this time, David’s mother, Kate enrolled him in a mainstream Catholic school where he attended from Year 3 until Year 12. When asked about David’s school experiences with mathematics and how his learning in mathematics has impacted on his life now in a post school setting, Kate said, “If I hadn’t got myself educated, he’d still be struggling … not knowing the days of the week … not knowing the time of day … these are the things that are foundational to be able to function in the world.” It was evident when interviewing David and Kate at their home, that Kate has invested an enormous amount of time since David has finished school, trying to teach David basic mathematics concepts such as time, money, addition and subtraction so that he can experience some independence in society.

Participant Group Three—Cooper, Lauren and Renee

Cooper is 23 years old and completed school five years ago. He attended a support unit in a mainstream public school for kindergarten; however, like David, encountered negative experiences with his teacher. As a result, his mother, Lauren enrolled him in a support school for the remainder of his school career. Lauren stated in her interview that Cooper “loved school, but it wasn’t until later on that we realised that he didn’t learn a lot at school … my daughter, Renee taught him how to read and write … he learned so much after he left school.” Lauren also stated that “he [Cooper] just never understood anything to do with maths. Counting, money, time he doesn’t understand that.” Cooper’s sister, Renee spoke about Cooper not understanding weather predictions. She gave the example of when it is forecast to be cold and raining, Cooper would get himself dressed in shorts and a t-shirt. She said, “we’ve had big

issues with this ... it is really frustrating for him now that he is an adult." Lauren also stated in the interview when discussing the basic numeracy skills needed to be able to independently function in society, "all those skills, he [Cooper] really didn't get them at school, which is a shame, because now he really does struggle." Like David, it appears that Cooper's experiences with mathematics at school, have also impacted on his ability to be able to function independently, now that he is an adult.

Participant Group Four—Kim, Joanne and Robert

Kim is 35 years old and completed school 17 years ago. She was in a mainstream class in a mainstream public school for her primary years of schooling and was enrolled in a support unit in a mainstream public high school for her secondary schooling. When asked about the importance of mathematics in Kim's life now that she has finished school and lives independently, Joanne and Robert spoke about the important role that Kim's schooling had in her learning of mathematics. Joanne said, "we were lucky, in those days we had lots of support in the classroom, we only had to get on the phone and say, Kim needs help with this, and the support was there." Kim spoke about her ability to be able to independently budget her money each week and proudly showed her weekly budgeting folder. When asked if these skills were something that Kim learnt at school, Joanne said "it was learnt at home, Kim taught herself how to do those things because she wanted to be independent."

Participant Group Five—Evelyn and Alison

Evelyn is 30 years old and completed school 12 years ago. She was enrolled in a support unit in a mainstream public school for both her primary and secondary schooling. Alison spoke of a teacher that Evelyn had in her primary school years, Mrs Peterson. She said "Mrs Peterson, is one of those people that should be cloned ... she was unbelievably fantastic, I felt like between them [Evelyn and Mrs Peterson] that they reached so many goals." Interestingly, Alison also said when discussing Evelyn's mathematics experiences, "I felt like it [mathematics] didn't get anywhere, but I didn't expect it to because there was so much other stuff to concentrate on ... we were trying to get language and reading happening." Alison also said that she felt that mathematics plays a rather large role in Evelyn's life now, that she is in a post school setting. Similarly, to David, Cooper, Kim and Noah, Alison stated that "most of her [Evelyn's] mathematics has been learnt since she finished school."

Participant Group Six—Noah, Melissa and Jackson

Noah is 36 years old and completed school 18 years ago. He attended a mainstream class in a Catholic school for his primary school years; however, due to negative experiences with teachers and other students, Noah's parents, Melissa and Jackson decided to enrol him in a supported setting in a Catholic school for Year 7 through to Year 12. Noah's parents spoke about their negative experiences encountered when Noah was in primary school. They said they "felt pressured to send Noah to a mainstream school" and stated when talking about the teachers' aide that supported Noah that "they were there to take him out of class, so that the rest of the class could get on with it and he did kind of whatever." Like Michael and Cooper, it appears that Noah also experienced limited opportunities. Similarly, to Cooper and David's experiences, Noah's parents also expressed the amount of work they have done since Noah has left school, to try and support him in developing his independence, "even at the start of this year, we were trying to teach Noah how to read and understand time." When asked, if they thought if Noah's mathematics skills were the result of what he learned at school or at home, Noah parents said, "it's definitely been more home-based than school-based."

Discussion and Conclusion

Analysis of interview data has revealed that irrespective of the type of school that was attended by the adult participants with DS when they were at school, negative mathematics experiences at school were commonplace, except in the case of Kim. These negative experiences appear to have manifested themselves into ongoing problems for this population and their parents/caregivers, navigating the world in a post-school setting. It appears that low teacher and school expectations in relation to mathematics were evident among most participants. Contrary to this were Kim's experiences; however, she too has had to learn the numeracy skills needed to experience independence, since leaving school. Similarly, all parent/caregiver participants expressed similar experiences relating to having to teach their child mathematics at home, after finishing school, to try and give them the opportunity to independently access society. Not having the opportunity at school to develop the skills needed to be prepared for their role as a community and workforce members (Education Council, Australia, 2019) is "disheartening and frustrating" as expressed by one parent. This paper contributes to our knowledge of the impact of negative school mathematics experiences on the quality of life of adults with DS navigating the world in post-school settings. It is imperative that more research be conducted to ensure that current and future DS learners in Australian schools, be given the opportunity to experience positive mathematics throughout their school career, developing the appropriate skills needed to prepare them to be able to engage, post school, as informed numerate citizens.

Acknowledgments

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